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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/677,587	10/02/2003	William K. Lo	65.0393	8215

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EXAMINER	
NGUYEN, SANG H	

ART UNIT	PAPER NUMBER
2877	

DATE MAILED: 08/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

H'A

Office Action Summary	**Application No.** 10/677,587	**Applicant(s)** LO, WILLIAM K.	
	Examiner Sang Nguyen	**Art Unit** 2877	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,11-15,17-23 and 26-47* is/are rejected.

7)☒ Claim(s) *7-10,16,24,25 and 48* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/02/03*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 01/02/03 has been entered. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 37-38 are rejected under 35 U.S.C. 102(b) as being anticipated by Ghislain et al (U.S. Patent No. 5,939,709).

Regarding claims 37-38; Ghislain et al discloses a hybrid scanning lens optical system, including;

a light delivery system and focusing optics, considered to be a laser (38 of figure 3A), laser optics (36a, 36b of figure 3A), an optical elements (32a, 32b of figure 3A), a beam splitter (34 of figure 3A), a focusing lens (30 of figure 3A), for forming an optical column considered to be the beam splitter (34 of figure 3A), the focusing lens (30 of figure 3A), and SIL probe (10 of figure 3A) with an optical axis figures 1 and 6A-6B); wherein said light delivery system (figures 3A-3B) for delivering light from a light source (38 of figure 3A), said light forming a beam (12 of figures 1A and 6A-6B) having a beam cross-sectional area (figures 1A, 6A-6B, and 7), said beam illuminating a sample DUT (20 of figure 1A) having a sample surface (figure 1A);

means considered XYZ positioning scanner stage (112 of figure 3B) for scanning said focusing optics across the DUT sample (20 of figures 3A-3B and 6) in a scan region, wherein said focusing optics (30 of figure 3B and 6A) being scanned in the xy plane (78 of figure 6A) , said xy plane (78 of figure 6A) being parallel to said sample surface (20 of figure 6A) and z stage (76 of figure 6A) being perpendicular to said sample surface (20 of figure 6A), wherein said scanning of said focusing optics providing high resolution imaging within said scan region (col.6 lines 1-19 and col.6 line 65 to col.7 line 5); and

means for providing low resolution imaging considered to be a CCD camera or imager (108 of figure 3B) across a large area of said DUT sample (20 of figure 3B). See figures 1-7

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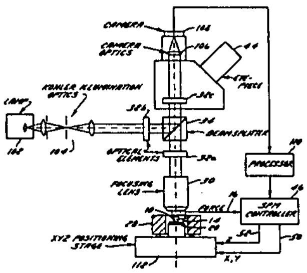

FIG. 3B

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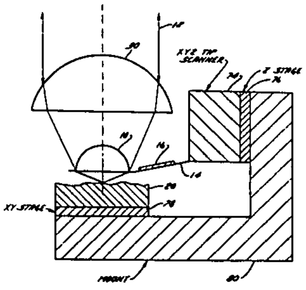

FIG. 6A

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 39-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghislain et al (U.S. Patent No. 5,939,709) in view of Cozier et al (U.S. Patent No. 6,441,359).

Regarding claim 39; Ghislain et al teaches all of features of claimed invention except for said focusing optics comprising an objective lens having a small field of view; a rotatable scan mirror in said optical column for raster scanning said beam across said DUT, and a controller for rotating said scan mirror to raster scan said beam. However, Cozier et al teaches that it is known in the art to provide a near field optical scanning system employing SIL having said focusing optics (26, 24, 19 of figure 1) comprising an objective lens (24 of figure 1) having a small field of view, a rotatable scan mirror (26 of figure 1) in said optical column for raster scanning said beam across said DUT sample (14 of figure 1); and a controller (38 of figure 1) for rotating said scan mirror (26 of figure 1) to raster scan said beam (23 of figure 1). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine a hybrid scanning lens optical system of Ghislain et al with said focusing optics comprising an objective lens having a small field of view; a rotatable scan mirror in said optical column for raster scanning said beam across said DUT, and a controller for rotating said scan mirror to raster scan said beam as taught by Cozier et al for the purpose of stepping motion creates a raster scanning pattern on the surface sample.

Regarding claim 40; Ghislain et al teaches all of features of claimed invention except for means for scanning said focusing optics comprises a fine xy stage for scanning said objective lens within said beam cross-sectional area, a controller for scanning said fine xy stage, said optical column remaining fixed. However, Cozier et al teaches that it is known in the art to provide a near field optical scanning system employing SIL having means for (38 of figure 1) scanning said focusing optics (19, 24, 26 of figure 1) comprises a fine xy stage (22 of figure 1) for scanning said objective lens (24 of figure 1) within said beam cross-sectional area (figures 1 and 5), a controller (38 of figure 1) for scanning said fine xy stage (22 of figure 1), said optical column remaining fixed (figure 1). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine a hybrid scanning lens optical system of Ghislain et al with means for scanning said focusing optics comprises a fine xy stage for scanning said objective lens within said beam cross-sectional area, a controller for scanning said fine xy stage, said optical column remaining fixed as taught by Cozier et al for the purpose of stepping motion creates a raster scanning pattern on the surface sample.

Regarding claim 41;Ghislain et al teaches said optical column (34, 30, 10 of figure 3A) being mounted on an xyz stage (22 of figure 3A) for scanning the optical column across the DUT sample (20 of figures 3A and 6A) in the xy plane (78 of figure

6A), wherein said xy plane (78 of figure 6A) being parallel to said sample surface (20 of figure 6A) and z stage (76 of figure 6A) being perpendicular to said sample surface (20 of figure 6A), a control system (46 of figure 3A) for operable controlling to move the xyz stage (22 of figure 3A) so as to scan the optical column (10 of figure 3A) across the DUT sample (20 of figure 3A).

Ghislain et al teaches all of features of claimed invention as indicated above except for focusing optics with a field of view (FOV) of at least 100 x 100 microns for diffraction limited numerical aperture (NA) as high as 3.0. However, Background of the Invention of Ghislain et al teaches that it is known in the art to provide focusing optics with a field of view (FOV) of at least 50 x 100 microns (col.5 lines 30-37) for diffraction limited numerical aperture NA of 1.4 (col.1 lines 15-52). It would have been obvious to one of ordinary skill in the art at the time the invention was made to a scanned optical system for use in optical probing applications of Ghislain et al with a field of view (FOV) of at least 100 x 100 microns for diffraction limited numerical aperture (NA) as high as 3.0, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claims 42-43; Ghislain et al teaches all of features of claimed invention as indicated above except for means for restricting the NA of said objective lens during said raster scanning and an aperture positioned in said light beam within said optical column. However, Cozier et al teaches that it is known in the art to provide means for restricting the NA of said objective lens during said raster scanning and an aperture positioned in said light beam within said optical column (col.6 lines 1-61 and figures 6-9). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine a hybrid scanning lens optical system of Ghislain et al with means for restricting the NA of said objective lens during said raster scanning and an aperture positioned in said light beam within said optical column as taught by Cozier et al for the purpose of improving by reducing the wavelength or increasing the numerical aperture.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-6, 11-15, 17-23, 26-33, 35-36, and 44-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghislain et al (U.S. Patent No. 5,939,709).

Regarding claims 1-5 and 45-47; Ghislain et al discloses a scanned optical system for use in optical probing applications, comprising:

a light delivery system and focusing optics considered to be a laser (38 of figure 3A), laser optics (36a, 36b of figure 3A), an optical elements (32a, 32b of figure 3A), a beam splitter (34 of figure 3A), a focusing lens (30 of figure 3A), wherein said light delivery system and focusing optics (28, 36a, 36b, 34, 30 of figure 3A) forming an optical column considered to be the beam splitter (34 of figure 3A), the focusing lens (30 of figure 3A), and SIL probe (10 of figure 3A) with an optical axis (figure 6A-6B and 7), wherein said light delivery system (figure 3A) for delivering light from a light source to illuminate a sample (20 of figure 3A) having a sample surface (figure 1A and 6A), wherein the optical column (34, 30, 10 of figure 3A) being mounted on an xyz stage scanner (22 of figure 3A) for scanning the optical column (34, 30, 10 of figures 3A and 6A-6B) across the sample DUT (20 of figure 6A) in the xy plane stage (78 of figure 6A), said xy plane stage (78 of figure 6A) being parallel to said sample surface (20 of figures 6A-6B) and z stage (76 of figure 6A) being perpendicular to said sample surface (20 of figure 6A);

a control system (46 of figure 3A) for operable moving the xyz stage scanner (22 of figure 3A) so as to scan the optical column (34, 30, 10 of figure 3A) across the sample DUT (20 of figure 3A), wherein said control system (46 of figure 3A) for providing said xyz stage scanner (22 of figure 3A) with a sufficiently large x-y scan range (col.7 lines 21-25) and said light being directed in a light beam (12 of figure 6A) substantially parallel to said optical axis (figure 6A) from a laser source (38 of figure 3A) and a photodetector (42 of figure 3A) is coupled to a processor (110 of figure 3B) for monitoring or detecting a response to the illumination with respect to the xy position of the stage and reflected or collection light by imaging optics considered to be collector lens (86 of figure 6B) or focusing lens (30 of figures 6A-6B) . See figures 1-7.

Ghislain et al teaches all of features of claimed invention as indicated above except for focusing optics with a field of view (FOV) of at least 100 x 100 microns for diffraction limited numerical aperture (NA) as high as 3.0. However, Background of the

Invention of Ghislain et al teaches that it is known in the art to provide focusing optics with a field of view (FOV) of at least 50 x 100 microns (col.5 lines 30-37) for diffraction limited numerical aperture NA of 1.4 (col.1 lines 15-52). It would have been obvious to one of ordinary skill in the art at the time the invention was made to a scanned optical system for use in optical probing applications of Ghislain et al with a field of view (FOV) of at least 100 x 100 microns for diffraction limited numerical aperture (NA) as high as 3.0, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 6; Ghislain et al teaches of the light source is a laser having a narrow wavelength distribution centered on a wavelength value (col.10 line 66 to col.11 line 5).

Regarding claim 11; Ghislain et al teaches of said light source is a laser (38 of figure 3A) having a narrow wavelength distribution centered on a wavelength value (col.10 line 66 to col.11 line 5), said optical column further includes a beamsplitter (34 of figure 3A) to separate reflected light at said laser wavelength value from photons emitted by the DUT sample (20 of figure 3A), and said beamsplitter (34 of figure 3A) diverts said photons emitted by said DUT sample (20 of figure 3A) into a photon emission timing port extending from said optical column (10, 30 of figure 3A).

Regarding claim 12; Ghislain et al teaches of optical probe system (figures 3A-3B) providing photon emission timing analysis considered to be a processor (110 of figure 3A) for analyzing photon emission timing signal.

Regarding claims 13-15, 17-18, 20, 22, and 26; Ghislain et al teaches of said focusing optics and said imaging optics comprises an immersion lens (10 of figure 3A and 6A-6B), wherein the immersion lens is an SIL (col.8 line 31).

Regarding claims 19, 21, 23, and 27; Ghislain et al teaches all of features of claimed invention as indicated above claims 1 and 45 except for the SIL has a NA of at least 2.5. It would have been obvious to one of ordinary skill in the art at the time the invention was made to a scanned optical system for use in optical probing applications of Ghislain et al with the SIL has a NA of at least 2.5, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claims 28-31; Ghislain et al teaches means considered to be a flexible cantilever (14 of figures 2 and 3A) of a cantilever substrate (18 of figure 2 and col.8 lines 20-30) for retracting said SIL (10 of figure 3A) from said sample surface (20 of figure 3A) while scanning said optical column across said DUT sample (figures 3A-3B and col.11 lines 45-55), wherein the means (14, 18 of figure 2) for having the SIL (10 of figure 3A) being mounted on a piezo-electrric crystal (figure 6A and col.9 lines 43-65 and col.10 lines 44-55) for operable oscillate the SIL (10 of figure 3A) in the Z-direction (figure 3A) of Z-stage (76 of figure 6A) and in the xy plane (figure 6A).

Regarding claims 32-33; Ghislain et al discloses a wear-resistant coating (82 of figure 7) having a thickness is provide for at least one of the SIL (10 of figure 7) and the sample surface (col.13 lines 42-58).

Regarding claim 35; Ghislain et al discloses the thickness of the wear-resistant coating (28 of figure 7) is smaller than wavelength of the light (col.13 lines 53-58).

Regarding claim 36; Ghislain et al discloses the wear resistant coating is comprised of a material selected from group consisting of NIR-transparent diamond film, diamond-like carbon film, titanium nitride, aluminum nitride, silicon carbide, and Bucky-balls. It would have been obvious to one of ordinary skill in the art at the time the invention was made to a scanned optical system for use in optical probing applications of Ghislain et al with the wear resistant coating is comprised of a material selected from group consisting of NIR-transparent diamond film, diamond-like carbon film, titanium nitride, aluminum nitride, silicon carbide, and Bucky-balls, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Regarding claim 44; Ghislain et al teaches the xyz scanner stage (22 of figure 3A and 5) having a low resolution stage having a large scan range in xy plane (66b of figure 5) and a high resolution stage considered z-stage (66a of figure 5) having a small scan range mounted onto the low resolution state (figures 3A, 5, 6A).

Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ghislain et al (U.S. Patent No. 5,939,709) in view of Cozier et al (U.S. Patent No. 6,441,359).

Regarding claim 34; Ghislain et al teaches all of features of claimed invention as indicate that the wear-resistant coating (82 of figure 7) has index of refraction higher than of Si SIL (col.13 lines 42-52), except for the wear resistant coating being near infrared transparent. However, Cozier et al teaches that it is known in the art to provide the wear resistant metal coating (21 of figure 5) on the SIL (19 of figure 5) being near infrared transparent (col.11 lines 10-222). It would have been obvious to one having ordinary skill in the art to provide a scanned optical system for use in optical probing applications of Ghislain et al with the wear resistant coating being near infrared transparent as taught by Cozier et al for the purpose of improving optical imaging with extremely high lateral resolution and improving aperture less near field microscope with a stronger signal level and reduced background level.

Allowable Subject Matter

Claims 7-10, 16, 24-25, and 48 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art of record, taken alone or in combination, fails discloses or render obvious a scanned optical system for use in optical probing applications comprising all the specific elements with the specific combination including of *an optical probe system for optically probing an electrical device on a DUT while operating the device under control of a tester, said tester operable to apply a sequence of test vectors to said device and said optical probe system operable to form an image from monitoring the* *response from one of the group consisting of; the DUT and the tester; to said sequence of test vectors* in combination with the set forth of the limitation of claims 7 and 48.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Fauver et al (6856712) discloses linear scanner with field of vow (FOV) see figures 1A-1D; Quake et al (6841096) discloses microfabricated lenses and method; Pakdaman et al (6778327) discloses bi-convex solid immersion lens; Hendriks et al (656894) discloses optical scanning device; Braat (6317276) discloses optical lens system and scanning device; Batchelder et al (5208648) discloses apparatus and method for high numerical aperture microscopic examination of materials.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sang Nguyen whose telephone number is (571) 272-2425. The examiner can normally be reached on 9:30 am to 7:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on (571) 272-2800 ext. 77. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SN
Sang Nguyen/SN

August 1, 2005

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Supervisory Patent Examiner
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05 Aug 05